Article

Taxonomic Studies of the Japanese Formicidae, Part 1

Introduction to This Series and Descriptions of Four New Species of the Genera Hypoponera, Formica and Acropyga

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Abstract

New species of Japanese ant will be described in a series of papers. As a first part the following four new species are described: *Hypoponera nubatama*, *Formica hayashi*, *Acropyga kinomurai* and *A. yaeyamensis*. *Hypoponera nubatama* is distinguished from the other East Asian congeners by having the following characteristics: antennal scapes reaching the posterior margin of head; eyes consisting of 3 facets and situated near the posterior margin of clypeus; petiolar node thin, with convex dorsal outline; body color black. [Distribution: Japan (Honshu, Kyushu)]. *Formica hayashi* seemingly resembles *F. japonica*, but can be distinguished from the latter by the number of erect hairs on 2nd gastral tergite excluding a row of hairs on posterior margin, relatively long antennal scapes and rounded posterolateral corners of head in frontal view. [Distribution: Japan (Hokkaido, Honshu, Shikoku, Kyushu, Yaku-shima; Korea]. *Acropyga kinomurai* is separated from the other Asian congeners by the 4-toothed mandibles, 11-segmented antennae, small eyes each consisting of 5-6 facets, wide head (CI>110) and flat dorsum of alitrunk. [Distribution: Japan (Yaeyama Is.)]. *Acropyga yaeyamensis* is distinctive in having the 4-toothed mandibles, 10-segmented antennae, and small body size (TL less than 2.0 mm). [Distribution: Japan (Yaeyama Is.)].

Key Words: Insecta, Hymenoptera, Formicidae, new species, Japan

During recent years, identification manuals of the Japanese ants have been published by the Myrmecological Society of Japan (1988, 1989, 1991, 1992) in an attempt to facilitate identifying the species. Although the series treated 247 species of 62 genera belonging to 8 subfamilies, it contained 84 unidentified species including many new species.

Not a few Japanese myrmecologists and colleagues, however, hope to use formal names than to use unstable common names to avoid unnecessary confusions in their papers.

The purpose of the present series is to formalize the taxonomic treatment of those species and those found threafter. The descriptions will be presented by different combinations of authors.

The following measurements and indices are used in this series of papers.

Head length (HL): maximum length of head excluding mandibles in full face view.
Head width (HW): maximum width of head in full face view.
Scape length (SL): maximum length of scape excluding the basal constriction or neck close to the condylar bulb.
Mandibular length (ML): straight length of mandible from the apex to the level through the anteriormost points of clypeal margin.
Cephalic index (CI): HW × 100 / HL.
Scape index (SI): SL × 100 / HW.
Mandibular index (MI): ML × 100 / HL.
Pronotal width (PW): maximum width of pronotum in dorsal view.
Weber's length of alitrunk (WL): maximum diagonal length of the alitrunk excluding the pronotal cervix, in lateral view.
Petiolar node length (PNL): maximum diagonal length of the petiolar node in lateral view.
Petiole length (PL): maximum diagonal length of the petiole in lateral view.
Petiole height (PH): maximum height of the petiole including the subpetiolar process, in lateral view.
Dorsal petiole width (DPW): maximum width of petiole in dorsal view.
Petiolar node index (PNI): DPW × 100 / PH.
Postpetiole length (PPL): maximum diagonal length of the postpetiole in lateral view.
Postpetiole height (PPH): maximum height of the postpetiole in lateral view.
Dorsal postpetiole width (PPW): maximum width of postpetiole in dorsal view.
Total length (TL): total length of outstretched individual, from the mandibular apex to the gastral apex.

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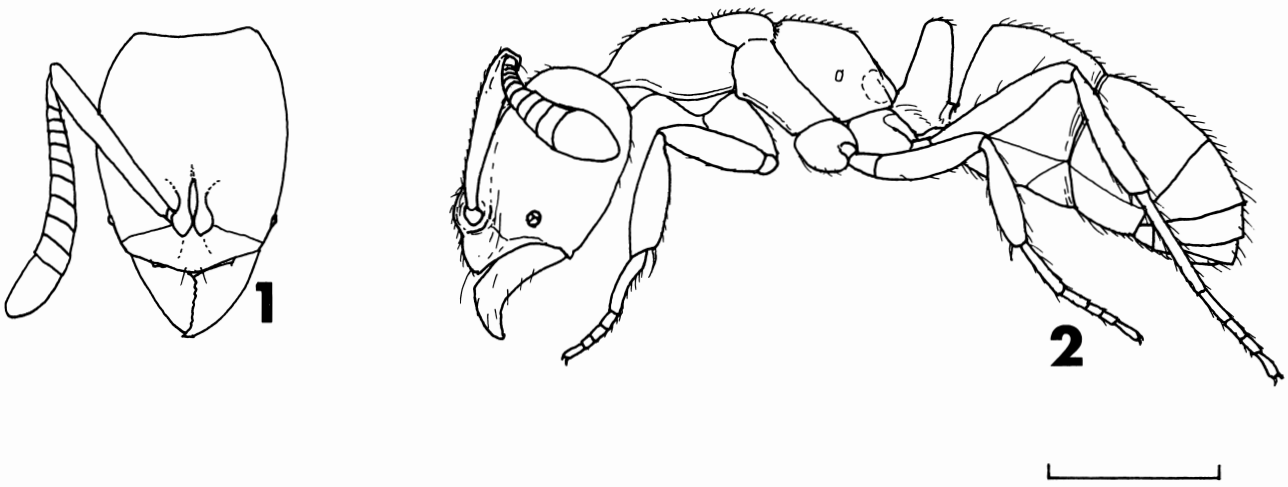


Figs. 1–2. *Hypoponera nubatama* sp. nov. (worker). 1, Head, frontal view. 2, body in profile. Scale bar = 0.5 mm.

Subfamily Ponerinae

Genus *Hypoponera* Santschi

Hypoponera Santschi, 1938, Bull. Soc. Ent. Fr., 43: 78 (as subgenus of *Ponera* Latreille, 1804). [Type species: *Ponera abeillei* André, 1881]

Up to the present, 133 described species of the genus have been known from the world (Bolton, 1995). This genus is distinguished from the other genera of the subfamily Ponerinae by the following combination of characteristics: 1) mandibles triangular; 2) frontal lobes present and frontal carinae lacking; 3) maxillary palpi 1-segmented and labial 1- or 2-segmented; 4) tarsal claws simple; 5) hind tibia with a single pectinate spur; 6) petiole with a distinct free posterior face and without posterodorsal spines; 7) subpetiolar process without an acute posteroventral angle and lacking an anterior fenestra.

In Japan, 8 species have been known in this genus (Ogata, 1987; Onoyama, 1988; Onoyama and Terayama, 1989). Among them, two species, listed as *Hypoponera* sp. 4 and *Hypoponera* sp. 6 in Onoyama and Terayama (1989), are unnamed. The former has been known since 1979 in Japan (Masuko et al., 1979; Terayama, 1981; Terayama and Masuko, 1984), and ecologial aspects are reported by Hashimoto (1995) and Hashimoto et al. (1995).

Hypoponera nubatama sp. nov. (Figs. 1–7)

Holotype. Worker. HL 0.68 mm; HW 0.56 mm; SL 0.50 mm; CI 85; SI 89; WL 0.90 mm; PNL 0.15 mm; PH 0.41 mm; DPW 0. 30 mm; TL 2.7 mm.

Head longer than wide, with weakly convex sides and straight posterior margin in frontal view. Mandibles triangular with an acute apical tooth followed by 8 small teeth. Clypeus with weakly convex anterior margin. Antennae with 12 segments; scape shagreened, relatively long, reaching the posterolateral corners of head in frontal view; pedicel longer than wide; 3rd to 11th segments each wider than long; terminal segment 1.8 × as long as wide; funicles not forming a distinct club. Eyes each consisting of 3 facets, and situated near the posterior margin of clypeus for this genus in profile.

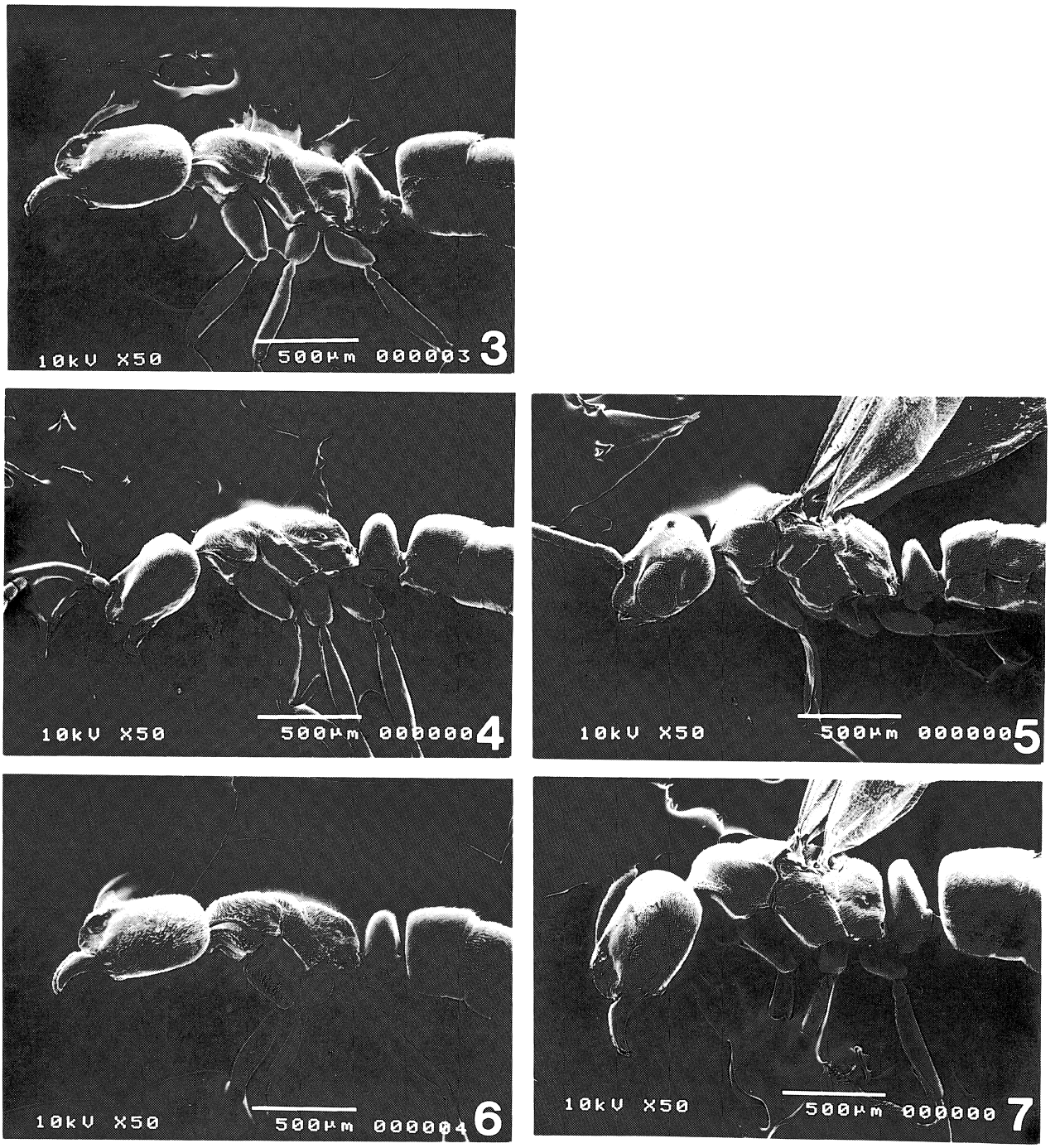
Alitrunk relatively weakly shagreened; dorsal outline almost straight in profile; pro-mesonotal and mesonotal-propodeal sutures distinct; mesonotal-mesepisternal suture obscure; metanotal groove distinctly incised dorsally; posterodorsal corner of propodeum angulate in profile. Petiolar node thin, 0.5 × as long as high, and converging toward the dorsum; dorsal outline strongly convex in profile. Subpetiolar process trapezoidal; anteroventral and posteroventral corners obtusely angulate.

Gaster weakly shagreened; 1st tergite 0.8 × as long as wide in dorsal view.

Body black; mandibles, antennae and legs reddish brown. Head and alitrunk abundant in subdecumbent pubscence.

Variations. Five paratype workers with the following measurements and indices: HL 0.66–0.70 mm; HW 0.54–0.60 mm; SL 0.50–0.53 mm; CI 81–87; WL 0.88–0.90 mm; PNL 0.15–0.18 mm; PH 0.41–0.45 mm; DPW 0.30–0.38 mm; TL 2.5–2.7 mm.

Female (queen) and male. This species produces usual reproductives (Figs. 5 and 7) and ergatoid queen and male (Figs. 4 and 6). These castes are described and figured by Hashimoto (1995).



Figs. 3–7. Castes of *Hypoponera nubatama* sp. nov. 3, Worker. 4, ergatoid male. 5, alate male. 6, ergatoid queen. 7, alate queen.

Holotype. Worker, Toda-shi, Saitama Pref., 3.IX.1993, M. Terayama leg.

Paratypes. 24 workers, 3 females, 1 males, same data as holotype; 14 workers, Chiba-shi, Chiba Pref., 13.VII.1992; 3 workers, Shonan-machi, Chiba Pref., 20.VIII.1993; 6 workers, 3 females, Katsushika-ku, Tokyo, 26.IX.1994, M. Terayama leg.; 1 worker, Itabashi-ku, Tokyo, 16. X.1990, M. Nishimura leg.; 1 female, 1 male, 1 worker, Yodogawa, Os-

aka, 24.VIII.1991, Y. Hashimoto leg.; 3 workers, same locality, 12.XI.1990, Y. Hashimoto leg.

Type depository. The holotype and some paratypes are deposited in the collection of Museum of Nature and Human Activities, Hyogo, and others are in National Institute of Agro-Environmental Sciences, Tsukuba, and National Science Museum, Tokyo.

Etymology. The specific name is from the classic Japanese noun "nubatama", which means darkness.

Remarks. Among the East Asian congeners, this species most resembles *Hypoponera opaciceps* (Mayr) in having the relatively long antennal scapes, trapezoidal subpetiolar process and blackish body color. It is, however, easily separated from the latter by the shape of petiolar node (viewed from the side; anterolateral and posterolateral margins converging above in *nubatama*; parallel in *opaciceps*). It is also distinguished from the other Japanese congeners by l) the relatively long antennal scape which reachs the posterior margin of head in frontal view, 2) eyes each consisting of 3 facets and situated near the posterior margin of clypeus in lateral view, 3) thin petiolar node, with strongly convex dorsal outline, 4) black body color.

This species corresponds to *Hypoponera* sp. 4 ("Kuroniseharіari" of Japanese name) in Onoyama and Terayama (1989), and is known from Honshu and Kyushu (Terayama and Kihara, 1994).

Subfamily Formicinae

Genus *Formica* Linnaeus

Formica Linnaeus, 1758, Systema naturae (Ed. 10), :579. [Type species: *Formica rufa* Linnaeus, 1858 (replacement type by Yarrow, 1954)]

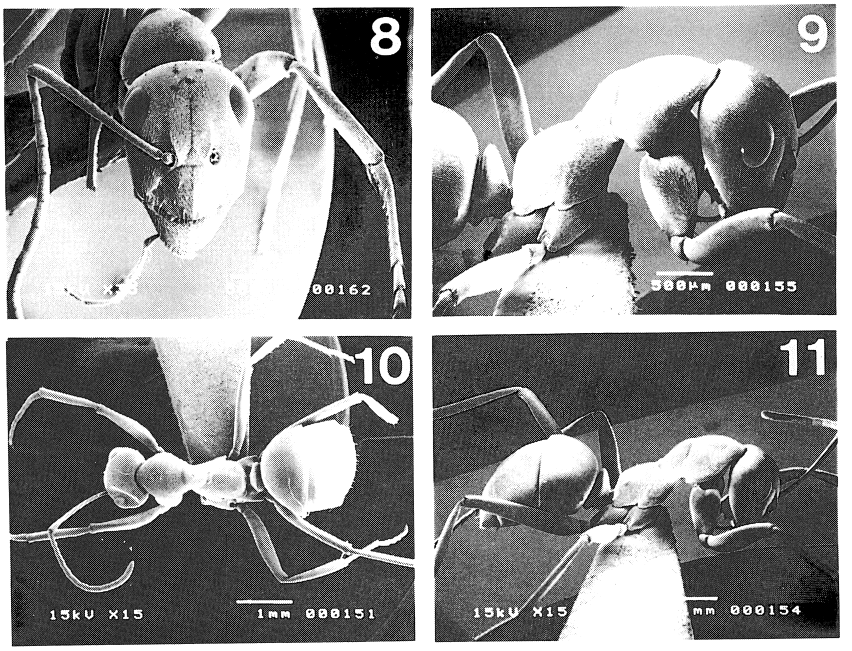
This is a relatively large genus containing 157 described species, most of which are found in the Paraearctic and the Nearctic Regions (Bolton, 1995).

This genus is distinguished from the other genera of the subfamily Formicinae by the following combination of characteristics: 1) mandibles triangular with more than 7 teeth, apical 3rd tooth smaller and shorter than the apical 4th; 2) antennae with 12 segments; 3) antennal sockets situated close to posterior margin of clypeus; 4) orifice of propodeal spiracle elongate-oval; 5) metapleural gland orifice present.

In Japan, 8 described and 1 unnamed species, listed as *Formica* sp. 5 in Sonobe and Onoyama (1991), have been known in this genus (Sonobe, 1977; Sonobe and Onoyama, 1991).

Formica hayashi sp. nov. (Figs. 8–12)

Holotype. Worker. HL 1.60 mm; HW 1.25 mm; SL 1.90 mm; CI 78; SI 152; WL 2.50 mm; PW 1.00 mm; LP 0.30 mm; PH 0.90 mm; DPW 0.65 mm; TL 6.3 mm.



Figs. 8–11. *Formica hayashi* sp. nov. (worker). 8, Head, frontal view. 9, head, alitrunk, and petiole, lateral view. 10, body, dorsal view. 11, ditto, lateral view.

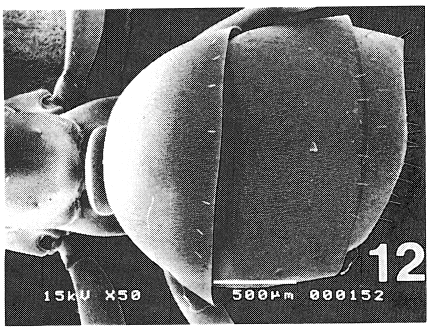


Fig. 12. *Formica hayashi* sp. nov. (worker). Gaster, dorsal view.

Head oval, 1.28 × as long as wide, with moderately convex posterior margin in frontal view; posterolateral corners rounded, not forming an angle. Mandibles triangular with 14 teeth of which basalmost to 4th larger. Clypeus with 8 golden suberect hairs except on the anterior margin; anterior margin forming a dull angle medially. Antennae slender; scape long, 1.52 × head width; pedicel 3.00 × as long as wide; 3rd segment 1.25 × as long as wide; 4th 2.18 × as long as wide; 5th 2.20 × as long as wide; terminal segment 3.00 × as long as wide; the relative length of funicular segments from the base 13:9:12:11:10:10:9:8.5:8.5:8:15. Eyes 0.45 mm in maximum length. Ocelli small, forming an obtuse triangle; anterior ocellus 0.07 mm in diameter.

Alitrunk slender without erect hairs; promesonotal dorsum convex; dorsal outline of petiole convex; propodeum sloping, and its posterolateral corner not forming an angle.

Petiole thin, without erect hairs, and with the dorsal outline weakly convex in frontal view.

Second gastal tergites without erect hairs excepting a row of hairs on posterior margin.

Body black; antennae and legs blackish brown; tarsi brownish.

Variations. Ten paratype workers with the following measurements and indices: HL 1.45–1.65 mm; HW 1.10–1.40 mm; SL 1.60–2.05 mm; CI 76–85; SI 146–150; WL 2.35–2.85 mm; AW 0.90–1.20 mm; PH 0.65–0.90 mm; PNL 0.35–0.40 mm; DPW 0.55–0.70 mm; TL 5.0–7.0 mm.

Holotype. Worker, Nakaizu-machi, Shizuoka Pref., 12.X.1993, M. Terayama leg.

Paratypes. 42 workers, same data as holotype; 10 workrs, Kawamoto-machi, Saitama Pref., 21.1V.1976, M. Terayama leg.; 1 worker, Mutsu-shi, Aomori Pref., 17–19.V.1993, M. Nishimura leg.; 4 workers, Tabayama-mura, Yamanashi Pref., 10.VII.1988, M. Nishimura leg.

Type depository. The holotype and some paratypes are deposited in the collection of Museum of Nature and Human Activities, Hyogo, and the others are in National Institute of Agro-Environmental Sciences, Tsukuba, and National Science Museum, Tokyo.

Etymology. The specific name is from the Japanese noun "hayashi", which means woodland (common Japanese name is also Hayashi-kuroyamaari). It is named after the habitat preference of this species.

Remarks. This species belongs to the *Formica fusca* group and quite resembles *F. japonica* Motschulsky known from Japan through Korea and eastern Siberia to Mongolia (Sonobe, 1977). It is, however, distinguished from the latter by the rounded posterolateral corners of head in frontal view (dully angulated in *japonica*), long antennal scapes (SI > 142)(SI < 142 in *japonica*; Sonobe and Onoyama, 1991), and the absence of erect hairs on the 2nd gastral tergites excepting a row of hairs on the posterior margin (less than 3 if present; more than 4 and usually much more in *Formica japonica*).

This species is commonly distributed from southern Hokkaido through Honshu and Shikoku to Yaku-shima, and nests in the ground of woodlands or woodland margins. It is also recorded from Korea (Sonobe and Onoyama, 1991; Terayama et al., 1992).

Genus *Acropyga* Roger

Acropyga Roger, 1862, Berl. Ent. Zeit., 6: 242. [Type-species: *Acropyga acutiventris* Roger, 1862]

This genus is distributed world-wide from the warm temperate region to the tropics and represented by 56 described species (Bolton, 1995).

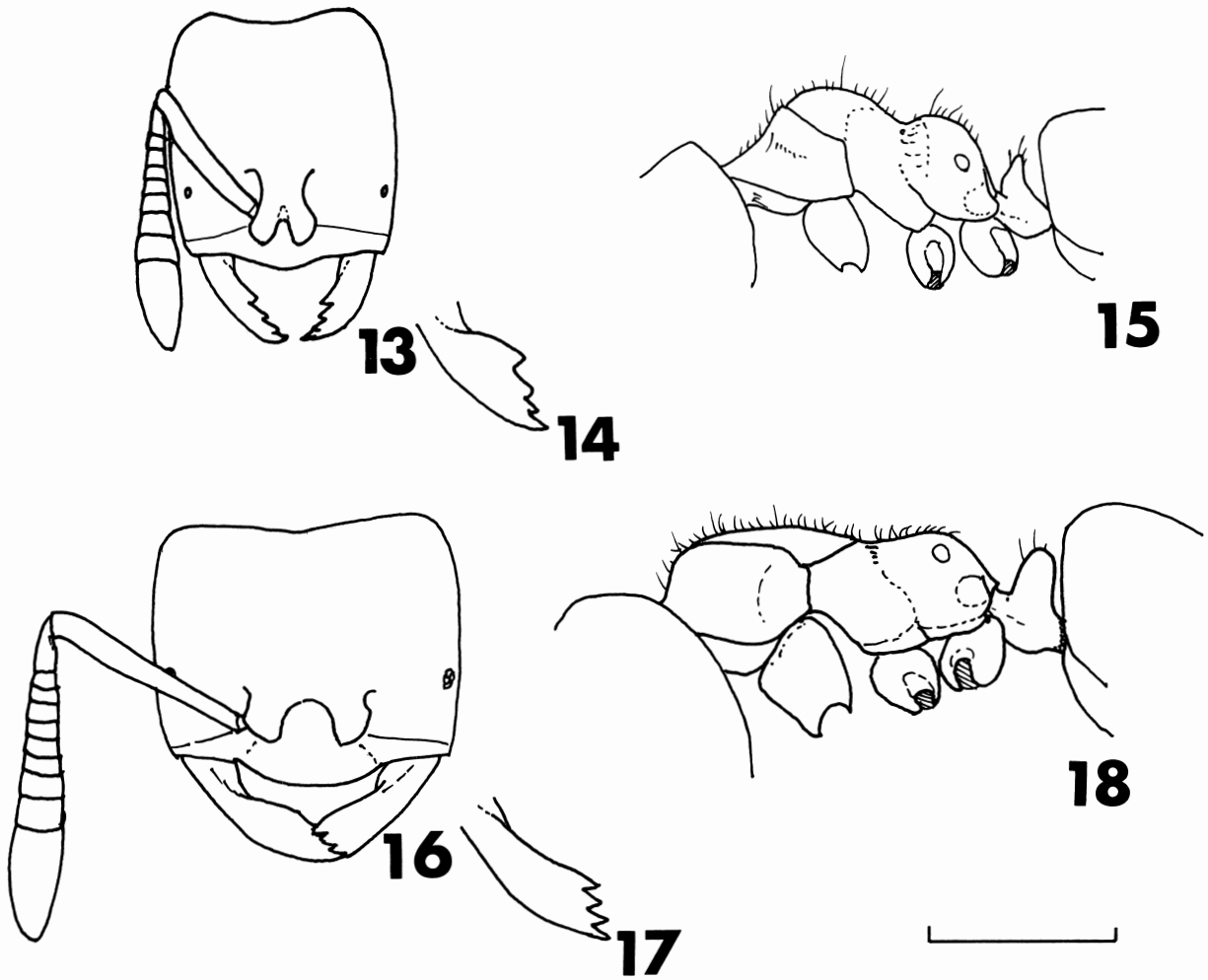
Among the formicine groups, this genus is characterized by the 7–11 segmented anntenae, the small eyes each consisting of less than 20 facets, and the 1–3 segmented maxillary and 3–5 segmented labial palpi.

Two described species, *A. sauteri* and *A. nipponensis*, have been known from Japan (Teranishi, 1929; Terayama, 1985). Recently 2 unnamed species which belong to the subgenus *Rhizomyrma* are added from the the Ryukyus (Terayama and Kubota, 1991; Terayama, 1994).

Acropyga (Rhizomyrna) yaeyamensis sp. nov. (Figs. 13–15)

Holotype. Worker. HL 0.40 mm; HW 0.38 mm; SL 0.28 mm; CI 95; SI 74; WL 0.40 mm; PL 0.05 mm; PH 0.13 mm; TL 1.7 mm.

Head almost as long as wide, with subparallel sides and shallowly concave posterior margin in frontal view; frons and vertex very weakly shagreened and subopaque. Mandibles with 4 teeth; apicalmost tooth acute; basalmost tooth broader than apical one. Antennae with 10 segments; scape short, not reaching the posterior margin of head; pedicel longer than wide; 3rd to 9th segments each wider than long; terminal segment 1.75× as long as wide; apical 3 segments in a ratio of about 1 : 1.5 : 7 in length. Eyes small,



Figs. 13–18. *Acropyga yaeyamensis* sp. nov. (worker; 13–15) and *Acropyga kinomurai* sp. nov. (worker; 16–18). 13 & 16, Head, frontal view. 14 & 17, right mandible. 15 & 18, alitrunk and petiole, lateral view. Scale bar = 0.5 mm.

consisting of a single facet only. Maxillary palpi with 2 segments; labial with 3 segments.

Alitrunk compact as in Fig. 15, largely smooth and shining; dorsum of mesonotum convex in profile; metanotal groove relatively distinctly incised; propodeal disc convex, posterodorsal corner not forming an angle; propodeal spiracles circular, situated at midlength of propodeum; mesonotal-propodeal suture obscure.

Scale of petiole thin with straight anterior margin and weakly concave posterior margin in profile; dorsal outline narrowly convex in profile. Subpetiolar process narrowly rounded.

Gaster weakly shagreened and subopaque.

Body pale yellow; mandibular teeth reddish brown. Dorsum of alitrunk and entire gaster with moderately abundant short erect hairs.

Holotype. Worker, Urauchi, Iriomote-jima, Yaeyama Is., Okinawa Pref., 28.III.1991, M. Terayama leg.

Paratypes. 3 workers, same data as holotype; 1 worker, Ishigaki-jima, Yaeyama Is., Okinawa Pref., M. Morisita leg.

Type depository. The holotype and paratypes are deposited in the collection of Museum of Nature and Human Activities, Hyogo.

Etymology. The specific name refers to the type locality.

Remarks. Among the Asian species of the subgenus *Rhizomyrma*, this species may resemble *A. oceanica* Emery from New Guinea in having the 4-toothed mandibles, short antennal scapes which do not reach the posterior margin of head, and small body size (TL less than 2.0 mm). It is, however, distinguished from the latter by the 10-segmented an-

tennae (8-segmented in *oceanica*). It is easily distinguished from other Japanese congeners by the 4-toothed mandibles (3- or 5-toothed except for the following new species), 10-segmented antennae (11-segmented in the other species), and small body size (HL < 0.42 mm and HW < 0.40 mm; HL > 0.45 mm and HW > 0.45 mm in the other species).

This species corresponds to *Acropyga* sp. 2 ("Yotsubaari" in Japanese name) in Terayama and Kubota (1991), and is known from Ishigaki-jima and Iriomote-jima, the Ryukyus (Terayama and Kubota, 1991; Terayama and Kihara, 1994).

***Acropyga (Rhizomyrma) kinomurai* sp. nov. (Figs. 16–18)**

Holotype. Worker. HL 0.45 mm; HW 0.53 mm; SL 0.40 mm; CI 118; SI 75; WL 0.53 mm; PL 0.05 mm; PH 0.15 mm; TL 1.8 mm.

Head subrectangular, wider than long, with parallel sides and very shallowly concave posterior margin in frontal view; frons and vertex weakly shagreened and subopaque. Mandibles with 4 acute teeth. Antennae with 11 segments; scape short, 0.89 × head length; pedicel longer than wide; 3rd to 10th segments each wider than long; terminal segment 2.33 × as long as wide; apical 3 segments in a ratio of about 1.5:2:7 in length. Eyes small, each consisting of 5–6 indistinct facets. Maxillary palpi with 2 segments; labial with 3 segments.

Dorsal outline of alitrunk almost straight in profile; pronotum weakly shagreened; disc of mesonotum extremely flat, 0.9 × as long as wide in dorsal view; mesopleura smooth and shining; matanotal groove absent; propodeum smooth, posterodorsal corner broadly rounded in profile; propodeal spiracles large, situated at upper 1/3 of propodeum.

Petiole higher than long, with convex posterior margin in profile; dorsal outline convex in profile. Subpetiolar process broadly rounded.

Gaster microreticulate.

Body yellow; mandibular teeth brown. Dorsa of head and alitrunk with abundant short erect hairs.

Holotype. Worker, Yoshino, Ishigaki-jima, Yaeyama Is., Okinawa Pref., 16.VIII.1985, K. Kinomura leg.

Paratypes. 13 workers, collected from the same nest from which the holotype was collected.

Etymology. This species in named after the collector, Mr. K. Kinomura.

Type depository. The holotype and paratypes are deposited in the collection of Museum of Nature and Human Activities, Hyogo.

Remarks. The nest was taken from under a stone on the ground, with ant-attended mealybugs, which belong to a new species of the subfamily Rhizoecinae (Homoptera, Pseudococcidae) (Terayama, in prep.).

Acropyga kinomurai is easily distinguished from the three known species, *A. sauteri* Forel, *A. nipponensis* Terayama and *A. yaeyamensis* sp. nov. from Japan by the relatively wide head which is wider than long and flat dorsum of alitrunk. This new species is similar to *A. indosinerris* Chapman and Capco from Indochina by the 11-segmented antennae and 4-toothed mandibles. It is, however, separable from the latter by the small eyes each consisting of 5–6 facets (more than 12 facets in *indosinerris*), short antennal scapes not reaching the posterior margin of head (reaching or a little beyond in *indosinerris*), and wide head (CI > 110; as long as wide in *indosinerris*).

This species corresponds to *Acropyga* sp. ("Hirase-yotsubaari" in Japanese name) of Terayama (1994) and *A.* sp. 4 of Terayama and Kihara (1994), and is known from Ishigaki-jima, the Ryukyus, only.

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